IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/26/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do <u>not</u> assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/26/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New Jersey State Projections
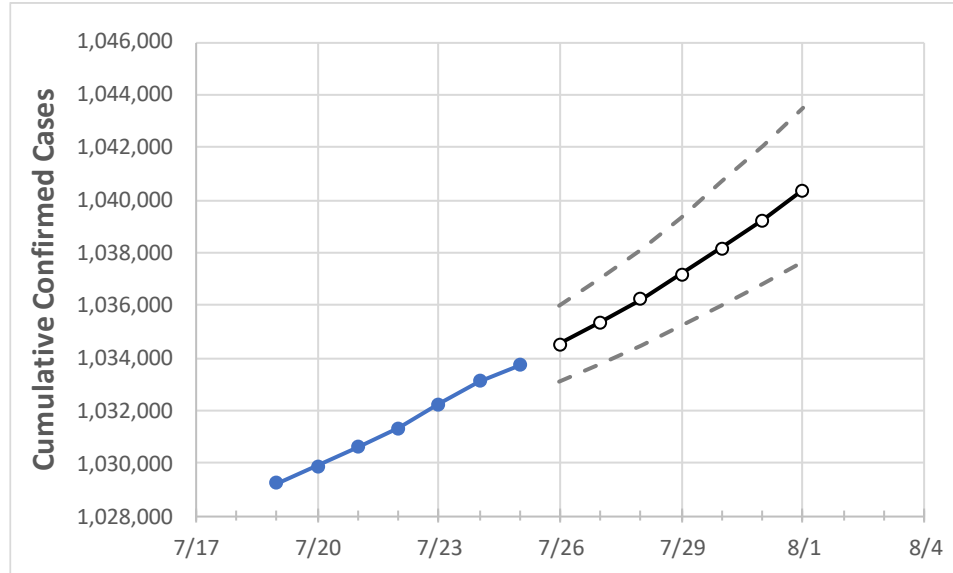
	Actual Confirmed Cases On:				Projected Cases For:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
New Jersey	1,031,346	1,032,255	1,033,116	1,033,712	1,034,513	1,035,361	1,036,246	1,037,182	1,038,182	1,039,233	1,040,360

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
Bergen	105,735	105,835	105,922	105,987	106,066	106,150	106,241	106,336	106,441	106,549	106,663
Burlington	44,777	44,813	44,860	44,894	44,934	44,977	45,022	45,071	45,123	45,178	45,237
Camden	56,404	56,435	56,466	56,488	56,520	56,553	56,587	56,622	56,658	56,695	56,734
Essex	95,271	95,329	95,415	95,466	95,557	95,658	95,765	95,877	96,002	96,134	96,273
Gloucester	30,949	30,974	30,988	31,005	31,027	31,050	31,074	31,099	31,126	31,154	31,184
Hudson	88,836	88,882	88,953	89,009	89,058	89,110	89,166	89,224	89,289	89,357	89,429
Hunterdon	9,990	9,996	10,008	10,013	10,020	10,027	10,035	10,043	10,051	10,059	10,068
Mercer	34,368	34,399	34,417	34,439	34,458	34,478	34,499	34,522	34,546	34,571	34,599
Middlesex	93,286	93,365	93,453	93,527	93,614	93,709	93,812	93,927	94,051	94,184	94,329
Monmouth	77,199	77,339	77,463	77,554	77,663	77,778	77,898	78,026	78,164	78,305	78,456
Morris	50,783	50,826	50,861	50,897	50,938	50,981	51,028	51,077	51,128	51,182	51,239
Ocean	77,237	77,343	77,421	77,454	77,516	77,581	77,648	77,719	77,791	77,867	77,947
Passaic	73,844	73,906	73,951	73,965	74,001	74,037	74,075	74,115	74,157	74,201	74,247
Somerset	30,499	30,534	30,566	30,578	30,601	30,625	30,651	30,677	30,705	30,735	30,764
Sussex	14,202	14,209	14,219	14,235	14,243	14,251	14,259	14,268	14,277	14,287	14,297
Union	72,264	72,316	72,374	72,404	72,450	72,497	72,548	72,601	72,657	72,717	72,779
Warren	10,104	10,109	10,104	10,106	10,110	10,115	10,119	10,124	10,129	10,134	10,139

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/22	7/23	7/24	7/25	7/27	7/29	7/31
Bergen	105,735	105,835	105,922	105,987	106,150 (21,230) [5,095] {2,548}	106,336 (21,267) [5,104] {2,552}	106,549 (21,310) [5,114] {2,557}
Burlington	44,777	44,813	44,860	44,894	44,977 (8,995) [2,159] {1,079}	45,071 (9,014) [2,163] {1,082}	45,178 (9,036) [2,169] {1,084}
Camden	56,404	56,435	56,466	56,488	56,553 (11,311) [2,715] {1,357}	56,622 (11,324) [2,718] {1,359}	56,695 (11,339) [2,721] {1,361}
Essex	95,271	95,329	95,415	95,466	95,658 (19,132) [4,592] {2,296}	95,877 (19,175) [4,602] {2,301}	96,134 (19,227) [4,614] {2,307}
Gloucester	30,949	30,974	30,988	31,005	31,050 (6,210) [1,490] {745}	31,099 (6,220) [1,493] {746}	31,154 (6,231) [1,495] {748}
Hudson	88,836	88,882	88,953	89,009	89,110 (17,822) [4,277] {2,139}	89,224 (17,845) [4,283] {2,141}	89,357 (17,871) [4,289] {2,145}
Hunterdon	9,990	9,996	10,008	10,013	10,027 (2,005) [481] {241}	10,043 (2,009) [482] {241}	10,059 (2,012) [483] {241}
Mercer	34,368	34,399	34,417	34,439	34,478 (6,896) [1,655] {827}	34,522 (6,904) [1,657] {829}	34,571 (6,914) [1,659] {830}
Middlesex	93,286	93,365	93,453	93,527	93,709 (18,742) [4,498] {2,249}	93,927 (18,785) [4,508] {2,254}	94,184 (18,837) [4,521] {2,260}
Monmouth	77,199	77,339	77,463	77,554	77,778 (15,556) [3,733] {1,867}	78,026 (15,605) [3,745] {1,873}	78,305 (15,661) [3,759] {1,879}
Morris	50,783	50,826	50,861	50,897	50,981 (10,196) [2,447] {1,224}	51,077 (10,215) [2,452] {1,226}	51,182 (10,236) [2,457] {1,228}
Ocean	77,237	77,343	77,421	77,454	77,581 (15,516) [3,724] {1,862}	77,719 (15,544) [3,731] {1,865}	77,867 (15,573) [3,738] {1,869}
Passaic	73,844	73,906	73,951	73,965	74,037 (14,807) [3,554] {1,777}	74,115 (14,823) [3,558] {1,779}	74,201 (14,840) [3,562] {1,781}
Somerset	30,499	30,534	30,566	30,578	30,625 (6,125) [1,470] {735}	30,677 (6,135) [1,473] {736}	30,735 (6,147) [1,475] {738}
Sussex	14,202	14,209	14,219	14,235	14,251 (2,850) [684] {342}	14,268 (2,854) [685] {342}	14,287 (2,857) [686] {343}
Union	72,264	72,316	72,374	72,404	72,497 (14,499) [3,480] {1,740}	72,601 (14,520) [3,485] {1,742}	72,717 (14,543) [3,490] {1,745}
Warren	10,104	10,109	10,104	10,106	10,115 (2,023) [486] {243}	10,124 (2,025) [486] {243}	10,134 (2,027) [486] {243}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.